

1.		
(a)	(i) <i>atrio-ventricular node (max 2)</i> {collects/ receives} {wave of excitation/ impulses} <u>from SAN</u> ; NOT signal passes on to {Purkyne fibres/Bundle of His}; allows delay before wave passed to ventricles/ stops atria and ventricles contracting at the same time;	2
	(ii) <i>Bundle of His and Purkyne fibres</i> conducts wave to {base/ apex} of ventricles/ heart; ensures contraction (from base) upwards;	2
(b)	(i) 11;	1
	(ii) 7;	1
	(iii) 1;	1
	(iv) 6;	1
	(v) 4;	1
	(vi) 2;	1
	(vii) 12;	1
	(viii) 10;	1
	Question 2 Total	[12]

2.		
(a)	(i) 24/ 25/26%;	1
	(ii) Any two from (vigorous) exercise/ OWTTE; high levels of (aerobic) <u>respiration</u> ; oxygen used/ needed (by muscle cells);	2 max
(b)	C/mouse;	1
(c)	(i) curve to right of C;	1
	(ii) Any three from (move to right) lowers affinity of <u>haemoglobin</u> for oxygen; <u>more</u> oxygen released/ oxygen <u>more</u> readily dissociates; at the same partial pressure of oxygen; for (aerobic) respiration;	3 max
(d)	Any three from curve shows haemoglobin has high affinity for oxygen; can{ pick up/ absorb} oxygen at {low partial pressure/ high altitude}/ can be become saturated with oxygen {more easily/ lower partial pressure/ at altitude}; Llama lives at high altitudes where oxygen is scarce; small change in partial pressure results in a large change in % saturation;	3 max
(e)	Curve A;	1
	Question 3 total	[12]

3.

- | | | |
|-----------------------|---|----------|
| <p>(a)</p> <p>(i)</p> | <p>(Oxygen) dissociation (curve);</p> | <p>1</p> |
| <p>(ii)</p> | <p>similar shaped curve drawn to left of given curve;
(must start/ end at same points)
NOT above 100%</p> | <p>1</p> |
| <p>(iii)</p> | <p>{Foetal haemoglobin/ it} has {higher greater} affinity for oxygen
(than adult)/ picks up oxygen easier/ more readily forms
oxyhaemoglobin/ reaches saturation at lower partial pressures;
NOT more quickly
(this ensures) <u>oxygen moves from mother('s blood) to foetus</u>
(in the placenta);</p> | <p>2</p> |
| <p>(b)</p> <p>(i)</p> | <p>Move to right;</p> | <p>1</p> |
| <p>(ii)</p> | <p>Bohr;</p> | <p>1</p> |
| <p>(iii)</p> | <p>(Muscles/ cells give off) more carbon dioxide/ higher partial
pressure of carbon dioxide;
carbon dioxide dissolves to make carbonic acid/lowering pH;
which reduces affinity of Haemoglobin for oxygen/reference to
Hydrogen displacing Oxygen from Haemoglobin/ oxygen
dissociates more readily; (more) oxygen is released added
demand when <u>muscles</u> need it (for aerobic respiration)/
OWTTE;</p> | <p>4</p> |

Question 5 Total

[10]

4.

- (a) Causes Bohr {shift/effect} / dissociation curve moves to right; Max 4
CO₂ combines with water to form carbonic acid / HCO₃⁻;
Dissociation to form H⁺ and HCO₃;
Hydrogen ions combine with haemoglobin;
Haemoglobinic acid formed / haemoglobin reduced;
Decreases affinity for oxygen;
More oxygen released / cannot hold as much oxygen;
NOT quicker / more easily.
- (b) (i) Foetal haemoglobin 54/55% and normal haemoglobin 35/36%. 1
Both for one mark;
- (ii) Greater affinity for oxygen; 3
More saturated than maternal / normal haemoglobin;
At all partial pressures of oxygen;
Oxygen will (always) pass from maternal to foetal haemoglobin;
- (iii) Oxygen store; OWTTE. 1

Question total 9

5.

(a)

Position	Time from start of wave(s)
SAN	
AVN	
Bundle of his	0.165;
Base of ventricles	0.205;
Top of ventricles	

2

(b)

Continues beating after removal from body;

1

(c)

Allows atria to complete contraction / completely empty;

3

Before wave passes to ventricles

/ before ventricles begin to contract;

Otherwise ventricles would not completely fill;

(d)

All blood forced out / if contraction was from top some blood would remain;

2

Via aorta and pulmonary artery;

All of muscle contracts with greater force

/ pressure from base upwards;

AV valves forced shut;

(e)

Cardiac control	Action of heart muscle	ECG activity
	atria contract / systole;	
		QRS wave/complex;

2

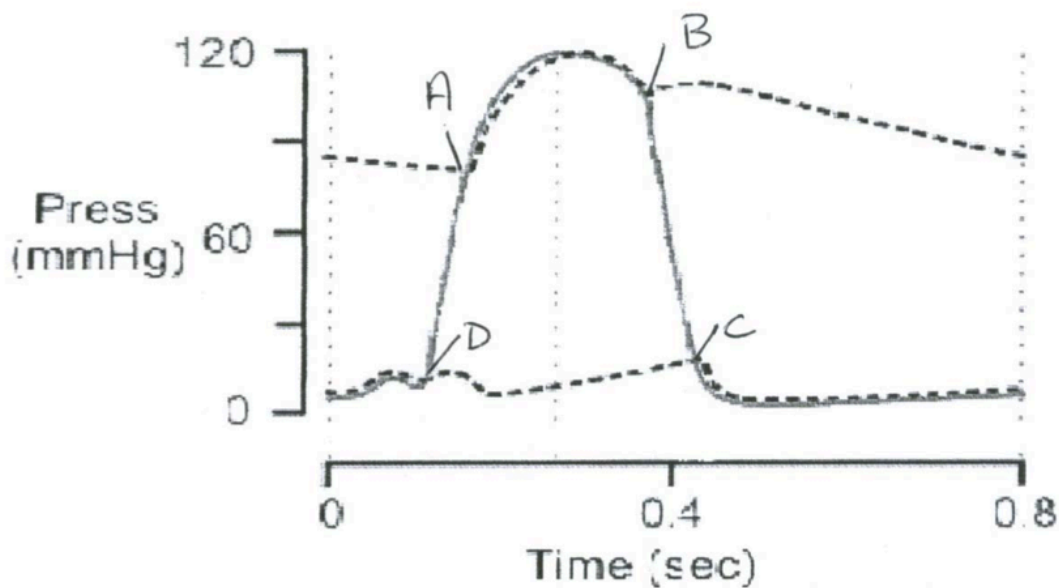
Question total

10

- 6.
- (a) (i) Contraction of {left ventricle/ ventricular systole} causes a {surge / increase in blood pressure}; 3
 pressure drops when the {left ventricle relaxes/ ventricular diastole};
 pressure in aorta does not fall to zero because of the closing of the {aortic / semi-lunar valve};
 {elastic recoil/ elasticity} of the arteries maintains blood pressure.
- (ii) Friction/ resistance with vessel walls / increased cross-sectional / 1
 surface area of arterioles / blood vessels distance from heart
 increased causes progressive pressure drop/ Not reference to capillaries
- (b) (i) R; 2
 highest pO_2 / oxygen level OR lowest pCO_2 / carbon dioxide
- (ii) **at arterial end:** max 3
 hydrostatic pressure (forcing liquid out of capillaries) greater than the osmotic pressure (drawing water in)
at venous end:
 hydrostatic pressure has decreased;
 water potential gradient / high osmotic pressure in capillary or osmotic pressure greater than hydrostatic pressure causes an inward flow
 ORA;
 not all water (re)absorbed into capillary, reject all references to blood
- (iii) Drains/ removes (excess) tissue fluid from the tissues / prevents 1
 build up of tissue fluid / return (excess) tissue fluid to blood via lymphatic system NOT ref to waste products alone

Question Total 10

7.



6. (a) (i) One mark for each correctly labelled point. 2
(ii) One mark for each correctly labelled point. 2
- (b) The (aortic) semi lunar valve closes
so preventing backflow of blood into the ventricle
(left) ventricle relaxing / diastole
2 from 3 2
- (c) One heartbeat takes 0.8 seconds
- Therefore $\frac{60}{0.8}$ seconds
- = 75 (beats per minute) 2
2 marks for correct answer, if incorrect could give 1 for correct figures and equation.
- (d) Correct ref. to wall/muscle thickness affecting pressure
Atrium pushes blood into the ventricle which is very close.
The ventricle has to push blood around the entire body.
The right ventricle has to push blood to the lungs which need a lower blood pressure/closer.
3 from 4. Points require qualification not just description
(not: ref. gravity) 3

Total 11 marks

8.

- (a) Haemoglobin line is S-shaped;
Actual line rises much more steeply between 2kPa and 7kPa/is steeper in the middle;
Theoretical line shows no flattening at top;
Haemoglobin shows higher saturation throughout.
(Any two) [2]
- (b) (i) Only haemoglobin is fully saturated at pp in lung [1]
- (ii) Haemoglobin carries much more oxygen for the muscle than the theoretical situation. [1]
- (iii) Compared with theoretical, haemoglobin gives up its oxygen much more readily as oxygen pp falls. [1]
- (c) Accumulation of carbon dioxide / carbonic acid. [1]
causes fall in pH / increased acidity. [1]
which releases oxygen from oxyhaemoglobin. [1]
- (d) Myoglobin is saturated/has high affinity for oxygen at very low pp [1]
acts as an oxygen store [1]
used when muscle is exercising heavily/working hard [1]

[Total 11 marks]

9.

- (a) In combination with haemoglobin /as carbamino-haemoglobin. [1]
Dissolved/in solution in the plasma. [1]
- (b) (i) Carbonic anhydrase. [1]
(ii) speeds up the reaction. [1]
- (c) (i) They pass (out of the corpuscle) into the plasma. (not: blood) [1]
(ii) They dissociate oxyhaemoglobin to release oxygen [1]
To be used in respiration by the muscle. [1]
(iii) Chloride/Cl⁻ (not: chlorine) [1]
Enters the corpuscle to replace bicarbonate/ in order to preserve electrical neutrality. [1]
- (d) Causes acidification in fresh and seawater. [1]
Extinction of fish in lakes / death of coral reefs / failure of shell formation in shellfish / any sensible suggestion based on aquatic fauna or flora. [1]
(not: affects organisms in the water)

[Total 11 marks]

10.

- (a) { linked marks
- (i) Biconcave (discs)/no nucleus. (allow: no organelles / labelled diag) 1
allow: full description (not: diagram alone) 1
 - (ii) Biconcave (discs) - increase SA:vol/flexibility/no nucleus-room to pack in haemoglobin.

- (b) 1

	A	B
		96
		20

- (c) (i) Increased carbon dioxide/increased acidity/lower pH 1
(not: ref. oxygen/temperature)

- (ii) Bohr shift/effect. 1

- (iii) Makes more oxygen available (during increased activity)/dissociates more easily/owtte/lowers affinity for oxygen 1
(not: ref speed/taking up O₂)

- (d) (i) Curve drawn to left of A. (start + end at same point as A + B) 1

- (ii) At low levels of oxygen/low partial pressures; 1
Hb has greater affinity/will become fully saturated/Hb will be able to absorb more oxygen from environment. 1
(not: lower amount/ref. llamas having affinity)

- (iii) More red blood cells/higher Hb concentration/more Hb 1
(Not: ref. affinity/viscous)

10 MARKS

11.

- | | | | |
|-----|--|--|-----|
| (a) | (i) | 4 | [1] |
| | (ii) | 4 (%) | [1] |
| (b) | small drop of partial pressure/concentration of oxygen (not: low pp);
large amount of oxygen supplied/dissociates more easily;
tissues can respire aerobically;
aerobic respiration far more efficient
than anaerobic / prevents lactic acid production. | | |
| | | (Max 2) | [2] |
| (c) | (i) | (respiring) muscles / liver/heart/placenta (not: lung tissue); | [1] |
| | (ii) | more oxygen released/affinity of haemoglobin for oxygen falls;
at same partial pressure/concentration of oxygen;
aerobic respiration; | |
| | | (Max 2) | [2] |
| (d) | (i) | Greater/higher affinity for oxygen; absorbs oxygen from mother;

becomes (fully) saturated at low pp oxygen; | |
| | | (Max 2) | [2] |
| | (ii) | Lives in an environment with low partial pressures/oxygen deficient;
allows haemoglobin to become (fully) saturated at these low partial
pressures/quoted figures; accept reverse argument;
/Haemoglobin has high affinity for oxygen | [2] |

12.

- (a) Pressure in the LV is pushing blood all around the body, whereas in the RV it is only pushing blood to the lungs;
the LV has a thicker, more muscular wall (which when fully contracted generates a much higher pressure.) (2)
- (b) Closure of the (semilunar) valves prevents backflow (and total loss of pressure) / elasticity / recoil of the muscular arterial wall maintains pressure on contents. (1)
- (c) The function of **arteries** is **transport** - which is efficient / arteries move blood at high speed / high pressure; (not: transport unequal.)
capillary function is **exchange** requiring / blood moves at slow speed / lower pressure / for diffusion. (2)
- (d) (i) Muscle capillaries have a higher, (more constant) pressure;
lung have a lower pressure.
Muscle capillaries pressure is constant. Lungs it fluctuates.
(not: ref. to data only) (2)
- (ii) Fluctuations in lung capillaries are due to the close proximity to the heart / respiratory movements or
muscle supplied by left ventricle (greater pressure) / lungs supplied by right ventricle. (1)
- (e) Massaging effect / contraction of muscles / (prevention of backflow) by valves / suction effect of the relaxing heart (not less resistance due to wider lumen). (1)

(Total 9 marks)

13.

- (a) *artery has:*
smaller lumen;
more / thicker muscle/tunica media;
more / thicker elastic/tunica externa;
regular shape / AW; [3 max]
accept reverse for vein
(not: ref. size/cell wall/valves)
- (b) (i) blood tries to flow back;
fills pocket
forces valve to close (in correct context) [2 max]
- (ii) no backflow;
situated above heart;
blood moves by gravity [1 max]
- (iii) lie next to (skeletal) muscle;
squeezes vein when muscle contracts;
pushes / forces blood towards heart
(not: suction effect of breathing) [2 max]

- (c) (i) possess haemoglobin/no nucleus so more haemoglobin carried;
(not: respiratory pigment)
forms oxyhaemoglobin / combines with or high affinity for oxygen;
- rbc have a large surface area;
- increased by biconcave shape;
- flexible / elastic membrane;
- allows greater contact with capillary walls/can squeeze through capillaries
[3 max]

14.

- (a) cardiac; 1 mark
- myogenic; 1 mark
- sino-atrial node; 1 mark
- atrio-ventricular node 1 mark
- bundle of His/Purkinje/Purkyne fibres; 1 mark
- contract; 1 mark
- pulmonary artery; 1 mark
- (b) large surface area to volume ratio;
substances/oxygen/carbon dioxide through membrane;
short diffusion pathway;
low metabolic rate;
diffusion supplies sufficient quantities;
fast enough; 4 max

(Total 11 marks)

15.

- (a) (i) $\frac{1.20}{5.00} \times 100;$
24
(-1 if wrong units given) 2 marks
- (ii) low(er) oxygen levels at higher altitudes;
more red blood cells, more haemoglobin;
haemoglobin carries oxygen;
more oxygen carried;
to maintain/support (aerobic) respiration;
maintain activities/named activities of person; 3 marks

stion	Answer/Explanatory Notes	Marks Available
(b) (i)	oxyhaemoglobin;	1 mark
(ii)	$92 \pm 2\%$	1 mark
(iii)	C;	1 mark
(c) (i)	curve B; left of C; greater affinity/attraction for oxygen;	2 max
(ii)	takes oxygen from mother's blood; at all partial pressures of oxygen; if to right/same as maternal haemoglobin oxygen wouldn't pass	2 marks
(d)	store of oxygen; holds on to oxygen/high O ₂ affinity; even at low partial pressures/only release oxygen at low partial pressures; when haemoglobin has given up its oxygen; maintains aerobic respiration;	2 max

(Total 14 marks)

16.

- | | | |
|-----|---|---|
| (a) | A <u>Agranulocyte/lymphocyte/monocyte</u> | 1 |
| | B Granulocyte/phagocyte/neutrophil | 1 |

For **A and B** if WBC's/Leucocytes ONE MARK ONLY

- | | | |
|---|---|---|
| C | Erythrocytes/Red corpuscles/red blood cells | 1 |
|---|---|---|

- (b) Bi concave disc increases SA: (Vol) for O₂ uptake;
(not: flattened)

No nucleus leaves more space for Hb;

Contains Hb which has an affinity for/combines with O₂;

Flexible shape/elastic membrane allows cells to squeeze through capillaries.

Max. 2

- | | | |
|-----|---|---|
| (c) | (i) As O ₂ pp decreases going into tissues more O ₂ is released/dissociated. | 1 |
| | (ii) HB fully saturated at relatively low pp | 1 |
| (d) | (i) Curved line drawn to the RHS of human <u>Hb</u> | 1 |
| | (ii) Bohr (effect) (correct spelling) | 1 |
| (e) | (i) Greater affinity for O ₂ (at lower pp)/more readily combines (not: ref to time/picks up) | 1 |
| | (ii) Low O ₂ conditions/pp O ₂ | 1 |

Total 11

17.

- | | | |
|-----|--|---------|
| (a) | (i) X = Semilunar valve/aortic valve;
Y = Bicuspid valve/ <u>atrio</u> ventricular/mitral; | 2 marks |
| | (ii) Atrial systole–Y open X closed; | 1 mark |
| | Ventricular systole–X open Y closed. | 1 mark |
| | Ventricular diastole–Y open X closed. | 1 mark |
| | (<u>valves</u> drawn as open or closed and in correct direction) | |
| | (iii) Keep tension on valves
<u>to</u> prevent inverting/being forced the wrong way | 2 marks |
| (b) | Mixing of blood;
(Some) deoxygenated pumped around body/oxygenated to lungs;
(<u>not</u> : reference to reduced pressure) | 2 marks |

18.

- (a) Large SA; total cross sectional area is large.
Small diameter, (*increased resistance slows blood down, reduces pressure*);
(*not: thin (walled)/narrow unqualified*)
Large number. 2 Max
- (b) Thickness of walls/impermeable 1 mark
- (c) Veins/venous branches. 1 mark
- (d) Contract and prevent dilation at ventricular systole;
(*allow: withstand pressure/recoil*)
Contract to increase blood pressure;

Vasoconstriction 2 Max
(*not: prevent bursting*)

19.

- (a) (i) 93(%) (92.1 → 93.9) 1
(ii) 6(%) 1
- (b) (i) 0.4 kPa (0.4 to 0.49) 1
(ii) 1.05 kPa (1.0 to 1.09) 1
(*(i) and (ii) missing units penalise once*)
- (c) (i) Increasing acidic conditions increases Hb saturation or higher pH lower saturation 1
(ii) Increasing acidic conditions decreases Hb saturation 1
- (d) (i) Hb has high affinity for O (at low O tensions) / Hb loses CO₂ / Hb increase oxygen pick up more readily 1
- (e) (i) Carbonic anhydrase is found inside RBC / because of the enzyme 1
(ii) chloride 1
(iii) To counteract HCO₃⁻ which move out / maintain charge across membrane 1
(*not: because of diffusion gradient / neutralise pH*)
(iv) CO₂ causes increase in H⁺ / more acidic conditions in RBC 1
Which causes Hb to give up more oxygen 1

[12]

20.

- | | | |
|-----|---|--------|
| (a) | 118 (mm Hg) | 1 |
| (b) | Aortic/Semilunar/valves at the beginning of the aorta;
(not: bicuspid/pocket)
<u>close</u> under aortic <u>pressure</u> , (preventing backflow). | 1
1 |
| (c) | The ventricle <u>relaxes</u> increasing its volume.
(allow: muscle, not: heart)
The volume increases more rapidly than it is being refilled/
decreases pressure. | 1
1 |
| (d) | Much lower pressure/no or less rhythmical fluctuation in pressure. | 2 |
| (e) | (i) Loss of fluid to tissues/much larger diameter of veins | 1 |
| | (ii) Massaging effect of muscles/presence of venous/pocket
valves. (<u>not</u> : semi lunar valve) | 1 |
| | | [9] |

21.

- | | | |
|-----|--|-------|
| (a) | arteries have thicker walls;

arteries have more muscle in walls;
(not: veins have no muscle)

more elastic in walls;

veins have valves;

arteries have smaller lumen;
(accept reverse points) | 3 max |
| (b) | (i) artery ; | 1 |
| | (ii) $5 \pm 0.5\text{kPa}$; | 1 |
| | (iii) contraction of ventricle/ventricular systole; | 1 |
| | (iv) ventricle relaxes/diastole; | 1 |
| | (v) further away from heart;

friction /more resistance;

increased cross sectional area of vessels; | 2 max |
| (c) | (i) separate systemic/body;

and pulmonary/lungs systems;

blood passes through heart twice during one complete
circuit | 2 max |
| | (ii) blood contained in vessels; | 1 |

[12]

22.

- | | | | |
|-----|------|--|-------|
| (a) | (i) | E; | 1 |
| | (ii) | C-D; | 1 |
| (b) | | decreases;
blood enters/forced into aorta;
(forced) out of ventricle; | 2 max |
| (c) | (i) | point where the two lines diverge; | 1 |
| | (ii) | pressure falls in ventricle;
below that in aorta;
blood tries to flow back;
forces valves to close; | 2 max |
| (d) | | sino atrial node;
(not: SAN) | 1 |
| | | | [8] |

23.

- | | | | |
|-----|---|---|---|
| (a) | A | sinoatrial node/SAN | 1 |
| | B | atrioventricular node/AVN | 1 |
| | C | purkinje/purkyne tissue/bundle of His | 1 |
| | A | generate/initiate (electrical) signal/impulse/pacemaker/
reference to myogenic | 1 |
| | B | distribute signal from atria to ventricles/hold up signal | 1 |
| | C | pass signal rapidly to base of ventricles/contracts from
apex upwards. | 1 |

[6]

24.

(a)	<i>Vein</i> thin wall/little muscle in wall/large (volume) lumen low pressure blood/large volume blood returning to heart valve/prevents backflow of blood	2
	<i>Capillary</i> thin wall/endothelium/wall one cell thick exchange of materials/formation of tissue fluid/short distance for diffusion	2
	<i>Artery</i> thick wall/muscle/elastic tissue high pressure blood (not: to pump blood)	2
(b)	valve/pocket valve (not: if valve given in table or specific valves)	1
		[7]

Essays

1.

- A. wall consists of three layers/ diagram of artery + vein labelled correctly;
- B. smooth endothelial (lining);
- C. to reduce friction;
- D. {outer layer/ tunica externa} of collagen (can be on diagram)
- E. to resist/prevent overstretching;
- F. artery has a thick wall to resist pressure;
- G. contain a thick layer of elastic tissue;
- H. { for elastic recoil/ small lumen} to maintain pressure;
- I. Smooth muscles in {small arteries/ arterioles} {regulate blood flow/pressure/ ref to vasoconstriction};
- J. arteries closer to the heart have more elastic tissue;
- K. semilunar valves in aorta/ pulmonary artery;
- L. Veins have valves to {prevent backflow of blood/ to maintain unidirectional flow};
- M. Walls are thin(ner) because blood at lower pressure;
- N. (skeletal) muscle contraction returns blood to heart;
- O. Large lumen reduces resistance to flow/ friction;

Question 7 Total

[10]

2.

- (b)
- | | | |
|---|--|---|
| A | Heart (muscle) is myogenic; | 1 |
| B | It can contract without any nerve stimulation; | 1 |
| C | The stimulus to contract originates in the sinoatrial node (SAN); | 1 |
| D | Which controls the rate of beating / acts as pacemaker; | 1 |
| E | It is situated in the wall of right atrium/auricle. (on diagram); | 1 |
| F | Electrical impulse from the SAN causes the two atria/auricles to contract; | 1 |
| G | Thin layer of connective tissue prevents the stimulus spreading to the ventricles; | 1 |
| H | At the bottom of the wall separating the two atria /auricles is the atrioventricular node AVN. (on diagram); | 1 |
| I | This delays the impulse (about 0.1 sec) before passing it to the ventricles; | 1 |
| J | The impulse is sent to the apex /tip of the ventricles; | 1 |
| K | Along bundle branches / Bundle of His; | 1 |
| L | And is conveyed upwards along Purkinje/ Purkyne fibres; | 1 |
| M | Causing (a wave of) ventricular contraction starting from the lowermost part of the ventricles; | 1 |
| N | The SAN may be stimulated by various factors to change its pacing; | 1 |
| O | One example – hormones (adrenalin), exercise, body temperature, etc. (allow ref. autonomic nervous system; | 1 |

Question 7 Total

[10]

3.

(b) Diagram

- A. With correct axes PPO₂
oxygen partial pressure (KPa) allow: oxygen tension
% Saturation of haemoglobin with oxygen
- B. Correct numbers
- C. Correct shaped curve for adult haemoglobin, labelled
- D. Correct position of curve for fetal haemoglobin, labelled
- E. Correct position of curve for Llama/lugworm, labelled or curve to left
labelled animal at light altitude
(note: Lines not to go over 100%)

Text

- F. Sigmoid / S shaped being more efficient
- G. More/easier O₂ loading in lungs/fully saturated at (relatively) low partial pressure
- H. Significance of this for living at altitude / low PPO₂
- I. More O₂ delivered to tissues
- J. Reduced affinity for O₂ at lower partial pressures
- K. Bohr Effect reduces haemoglobin affinity for O₂ / more O₂ is delivered to respiring tissues
- L. Correct biological explanation for this – acidity reduces affinity Hb for O₂
- M. Ref. myoglobin or position on graph
- N. Correct explanation for foetal haemoglobin curve position, i.e. ref. affinity
- O. Correct explanation for Llama/lugworm curve position i.e. ref. affinity higher
(Note: G+H in context of loading and marks transferable to different organisms;
I+J in context of unloading)

10 of the 15 marks available

4.

- (a) A. Double circulation / left and right sides of heart completely separated.[1]
- B. RHS atrium connected to ventricle through tricuspid valve. [1]
- C. LHS atrium connected through bicuspid or mitral valve. [1]
- D. Vena cava brings deoxygenated blood from body to right atrium. [1]
- E. Pulmonary artery carries blood from right ventricle to lungs. [1]
- F. Pulmonary vein brings blood from lungs to left atrium. [1]
- G. Aorta carries blood from left ventricle to general body circulation. [1]
- H. Backflow is prevented by semi lunar valves [1]
- I. Heart is a pump driven by muscle which is thickest in left ventricle. [1]
- J. The coronary artery, supplies the heart muscle. [1]
- K. Aorta then branches into arteries and smaller arterioles supplying all body tissues. [1]
- L. Arteries - small lumen; thick layer of elastic tissue/muscle; endothelial lining. [1]
- M. Veins - wide lumen; little elastic tissue/thin muscle layer; endothelial lining; [1]
- N Veins have (pocket) valves along their length. [1]
- O. Capillaries – endothelium only/ one cell thick; connection between arteries and veins. [1]

[Ten marks can be awarded from the fifteen available]

5.

- A. Heart muscle is myogenic. [1]
(allow: heart is myogenic, conference only)
- B. It can contract without any nerve stimulation. [1]
- C. The stimulus to contract originates in the sinoatrial node (SAN). [1]
- D. Which controls the rate of beating / acts as pacemaker. [1]
- E. It is situated in the wall of the right auricle / atrium. [1]
- F. Electrical impulse from the SAN causes the two auricles / atria to contract. [1]
- G. Thin layer of connective tissue prevents the stimulus spreading to the ventricles. [1]
- H. At the bottom of the wall separating the two auricles / atria is the atrioventricular node AVN. [1]
- I. This delays the impulse (about 0.1 sec) before passing it on to the ventricles. [1]
- J. The impulse is sent to the tip/apex of the ventricles [1]
- K. Along bundle branches (Bundle of His); [1]
- L. And is conveyed upwards along the branching Purkinje fibres [1]
- M. Causing a wave of ventricular contraction starting from the lowermost part of the ventricle; [1]
- N The SAN may be stimulated by various factors to change its pacing [1]
- O. One example – hormones (adrenalin), exercise, body temperature, etc. (allow: ref. autonomic nervous system) [1]

[Ten marks can be awarded from the fifteen available]

6.

- (a)
- A. Heart muscle is myogenic/contraction is initiated from within the muscle itself
(~~not~~ heart)
 - B. Initiated at the SAN/pacemaker.
 - C. Wave of (~~depolarisaton/impulses/excitation~~) pass over atria walls causing contraction of atria.
 - D. Cannot pass to ventricles because of layer of (~~non-conductive/insulative~~) tissue/collagen fibres.
 - E. (Right left) both atria contract simultaneously/eq.
 - F. ~~Depolarisaton/impulses~~ converges on/arrives at the AVN.
 - G. Mention of delay.
 - H. So that atria contract before ventricles.
 - I. Depolarisation passes down septum walls.
 - J. Through ~~Purkyne/Purkinje~~ tissues/Bundles of His.
 - K. To apex of heart.
 - L. ~~Depolarisaton~~ passes upwards through ventricle walls/muscle.
 - M. So heart contracts from apex upwards.
 - N. So pushing blood into the arteries/PA/Aorta.
 - O. Some mention of nervous supply to heart/mention of effect of adrenaline.

10 marks from the available 15

7.

(a)	(i)	93(%) (92.1 → 93.9)	1
	(ii)	6(%)	1
(b)	(i)	0.4 kPa (0.4 to 0.49)	1
	(ii)	1.05 kPa (1.0 to 1.09) ((i) and (ii) missing units penalise once)	1
(c)	(i)	Increasing acidic conditions increases Hb saturation or higher pH lower saturation	1
	(ii)	Increasing acidic conditions decreases Hb saturation	1
(d)	(i)	Hb has high affinity for O (at low O tensions) / Hb loses CO ₂ / Hb increase oxygen pick up more readily	1
(e)	(i)	Carbonic anhydrase is found inside RBC / because of the enzyme	1
	(ii)	chloride	1
	(iii)	To counteract HCO ⁻ which move out / maintain charge across membrane (not because of diffusion gradient / neutralise pH)	1
	(iv)	CO ₂ causes increase in H ⁺ / more acidic conditions in RBC Which causes Hb to give up more oxygen	1 1
			[12]

8.

- | | | | |
|-----|-----|---|---|
| (a) | (a) | (large vessels) have three layers in their walls | 1 |
| | (b) | (tough) collagen, elastic/muscular layer/endothelium/
correct reference to tunicae/description. Any 2. | 1 |
| | | (Accept in drawing) | |
| | (c) | arteries deliver blood from heart/to other organs | 1 |
| | (d) | they (elastic layer) resist/are under high pressure | 1 |
| | (e) | smooth pressure pulses into continuous pressure | 1 |
| | (f) | maintain blood pressure through elastic recoil
(not: help pump blood) | 1 |
| | (g) | adjust their diameter to control blood flow | 1 |
| | (h) | veins have thinner muscle layer than arteries | 1 |
| | (i) | and relatively wider/large lumen | 1 |
| | (j) | valves to ensure flow in one direction | 1 |
| | (k) | veins deliver blood (from organs) to heart | 1 |
| | | Available | |
| | (l) | endothelium is smooth (to reduce friction) | 1 |
| | (m) | capillaries have narrow lumen, restricting flow and
slowing blood/reducing pressure | 1 |
| | (n) | capillary wall just one cell thick
(not: moist/thin) | 1 |
| | (o) | features increase the efficiency of exchange of
materials/easier diffusion | 1 |

Maximum 10 marks from available 15

Points a, b and n may be awarded for suitably labelled diagrams, annotations are required for those points making comparisons or relating structure to function.

[10]

9.

- A unicellular organisms use diffusion
- B multicellular organisms are large
- C metabolically more active
- D substances need to travel distances/around the body
- E diffusion only efficient over short distance/too great for diffusion
- F diffusion too slow
- H ref. surface area to volume ratio being too small in multicellular organisms
- I for uptake of nutrients/named nutrient
- J oxygen
- K removal of waste products
- L carbon dioxide/urea
- M system/lungs/gills required to distribute/absorb substance/named substance
- N quickly
- O in sufficient quantities due to large surface area
- P so processes/named processes operate efficiently

Maximum 10 marks

10